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(54) APPARATUS AND METHOD FOR AUTOMATIC PRODUCTION OF DISASSEMBLING DRAWING, AND RECORDING MEDIA

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an apparatus and method for automatic production of a disassembling drawing, and recording media capable of simply producing a disassembling drawing.
SOLUTION: The apparatus 1 for automatic production of a disassembling drawing comprises a control unit 2, an input device 3, an output device 4, database 7 for shapes of parts, and database 8 for assembly structures. Data for the shapes of the parts regarding a product are memorized in the database 7 for the shapes of the parts. Data for assembly structures and assembling conditions are memorized in the database 8 for assembly structures. The control unit 2 provides the disassembling drawing of the product by replacing a disposed position of the parts such that the parts are moved in a disassembling direction that is determined by the data for assembling conditions, on the basis of the data for assembly structures and assembling conditions.
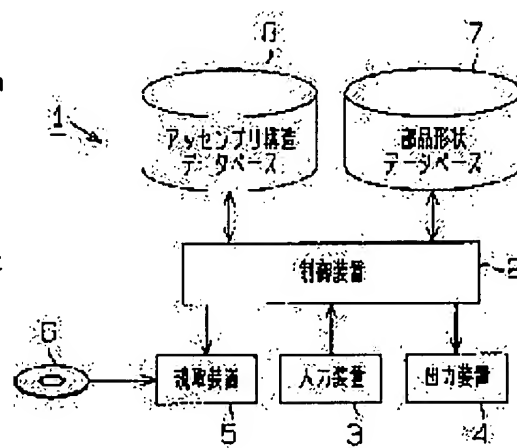
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(54)【発明の名称】　　分解図自動作成装置、分解図自動作成方法及びその記録媒体

(57)【要約】

【課題】　簡単に分解図を作成することができる分解図自動作成装置、分解図自動作成方法及びその記録媒体を提供する。

【解決手段】　分解図自動作成装置1は制御装置2、入力装置3、出力装置4、部品形状データベース7およびアッセンブリ構造データベース8を備えている。部品形状データベース7には製品に関する部品の形状データが記憶される。また、アッセンブリ構造データベース8にはアッセンブリ構造データと組付条件データが記憶される。制御装置2はアッセンブリ構造データと組付条件データを基に、その組付条件データから決まる分解方向に部品を移動することにより部品の配置位置を換えて製品の分解図を作成する。
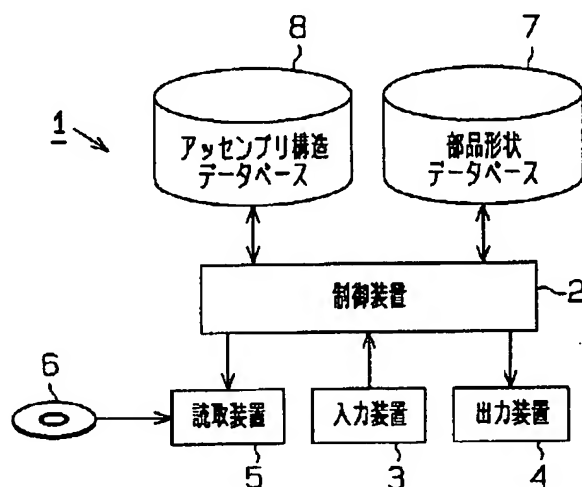
【特許請求の範囲】

【請求項1】　製造対象物に関する設計図面をコンピュータ支援のもとに作成する分解図自動作成装置であって、

前記製造対象物に関する部品の形状データと、分解図を作成するために必要な分解条件データとを記憶する記憶手段と、

前記分解条件データを基にして、前記形状データから作図される部品の配置位置を換えることで前記設計図面の分解図を作成する分解図作成手段とを備えたことを特徴とする分解図自動作成装置。

【請求項2】　前記分解条件データは各部品間の関係を示すアッセンブリ構造データと、分解時の部品の移動方向を示す分解方向条件データとからなり、前記分解図作成手段はアッセンブリ構造データと分解方向条件データとを基に、該分解方向条件データから決まる分解方向へ前記部品の配置位置を換えることで前記分解図を作成することを特徴とする請求項1に記載の分解図自動作成装置。

【請求項3】　前記分解方向条件データは前記設計図面の組付図を作成するときに部品を組み付けるための組付条件として入力する組付条件データであり、前記分解図作成手段は前記組付条件データを基に、前記部品の配置位置を換えることで前記分解図を作成することを特徴とする請求項2に記載の分解図自動作成装置。

【請求項4】　製造対象物に関する設計図面をコンピュータ支援のもとに作成する分解図自動作成方法であって、

前記製造対象物に関する部品の形状データと、分解図を作成するために必要な分解条件データとが記憶手段に記憶され、分解図作成手段が前記分解条件データを基にして、前記形状データから作図される部品の配置位置を換えることによって前記設計図面の分解図が作成されることを特徴とする分解図自動作成方法。

【請求項5】　製造対象物に関する部品の形状データと、分解図を作成するために必要な分解条件データとを取り込み、コンピュータがそれらを記憶手段に記憶するステップと、

分解図作成指令に応答して、前記コンピュータが前記形状データから作図される部品の配置位置を前記分解条件データを基に換えることによって前記製造対象物に関する設計図面の分解図を作成するステップと、

前記コンピュータが前記分解図を出力手段に出力させるステップとをコンピュータに実行させるためのプログラムを記録したコンピュータ読み取り可能な記録媒体。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、分解図自動作成装置、分解図自動作成方法及びその記録媒体に関するものである。

【0002】

【従来の技術】近年、自動車部品等の製品（部品）を設計するにあたって、コンピュータ支援による設計システムであるCADが広く利用されている。このCADシステムを利用した製品の設計には、それまでの紙面上での製品の設計と比較して、データの加工や修正が容易である、シュミレーションが可能になる、過去のデータの検索や再利用が容易であるなどの数多くの利点がある。

【0003】

【発明が解決しようとする課題】ところで、CADシステムを用いて作成したCADデータを基に、部品を組み立てる際の組立手順を示すマニュアルを作成する場合がある。このマニュアル作成作業はCADシステムを用いた設計作業とは独立した機関で行われるのが一般的であり、現状では各機関が独自にCADデータを基にマニュアルを作成している。

【0004】このマニュアルには部品の組立てを段階的に説明するために分解図を載せる必要があるが、その分解図はCADデータを基に手作業で作成するのが現状であった。従って、マニュアル作成、つまり分解図作成には非常に手間がかかり、分解図作成が面倒、分解図作成の長時間化、分解図上でミスが発生し易いなどの問題が生じていた。

【0005】本発明は前記の問題点に鑑みてなされたものであって、その目的は、簡単に分解図を作成することができる分解図自動作成装置、分解図自動作成方法及びその記録媒体を提供することにある。

【0006】

【課題を解決するための手段】上記問題点を解決するために、請求項1に記載の発明では、製造対象物に関する設計図面をコンピュータ支援のもとに作成する分解図自動作成装置であって、前記製造対象物に関する部品の形状データと、分解図を作成するために必要な分解条件データとを記憶する記憶手段と、前記分解条件データを基にして、前記形状データから作図される部品の配置位置を換えることで前記設計図面の分解図を作成する分解図作成手段とを備えたことを要旨とする。

【0007】この発明によれば、分解図作成手段は記憶手段に記憶された分解条件データを基にして、形状データから作図される部品の配置位置を換えることで設計図面に関する分解図を作成する。従って、製造対象物に関する組立作業マニュアルを提供する際に分解図が自動で作成され、面倒な作図作業をすることなく簡単に分解図が得られる。

【0008】請求項2に記載の発明では、請求項1に記載の発明において、前記分解条件データは各部品間の関係を示すアッセンブリ構造データと、分解時の部品の移動方向を示す分解方向条件データとからなり、前記分解図作成手段はアッセンブリ構造データと分解方向条件データとを基に、該分解方向条件データから決まる分解方

向へ前記部品の配置位置を換えることで前記分解図を作成することを要旨とする。

【０００９】この発明によれば、請求項１に記載の発明の作用に加え、分解図作成は分解図作成手段がアッセンブリ構造データと分解方向条件データを基に、分解方向条件データから決まる分解方向へ部品の配置位置を換えることにより行われる。

【００１０】請求項３に記載の発明では、請求項２に記載の発明において、前記分解方向条件データは前記設計図面の組付図を作成するときに部品を組み付けるための組付条件として入力する組付条件データであり、前記分解作成手段は前記組付条件データを基に、前記部品の配置位置を換えることで前記分解図を作成することを要旨とする。

【００１１】この発明によれば、請求項２に記載の発明の作用に加え、分解図作成手段は設計図面の組付図を作成するときに組付条件として入力した組付条件データを基に、部品の配置位置を換えることで分解図を作成する。従って、組付条件データを基にして分解図作成が行われるので、分解図作成のための新たなデータを必要とせず、分解図作成に関するデータを新たに入力する必要がない。

【００１２】請求項４に記載の発明では、製造対象物に関する設計図面をコンピュータ支援のもとに作成する分解図自動作成方法であって、前記製造対象物に関する部品の形状データと、分解図を作成するために必要な分解条件データとが記憶手段に記憶され、分解図作成手段が前記分解条件データを基にして、前記形状データから作図される部品の配置位置を換えることによって前記設計図面の分解図が作成されることを要旨とする。

【００１３】この発明によれば、製造対象物に関する部品の形状データと、分解図を作成するために必要な分解条件データとが記憶手段に記憶される。そして、分解図作成手段がこれらデータを用いて、形状データから作図される部品の配置位置を分解条件データを基に換えることによって分解図が作図される。従って、製造対象物に関する組立作業マニュアルを提供する際に分解図が自動で作成され、面倒な作図作業をすることなく簡単に分解図が得られる。

【００１４】請求項５に記載の発明では、製造対象物に関する部品の形状データと、分解図を作成するために必要な分解条件データとを取り込み、コンピュータがそれらを記憶手段に記憶するステップと、分解図作成指令に応答して、前記コンピュータが前記形状データから作図される部品の配置位置を前記分解条件データを基に換えることによって前記製造対象物に関する設計図面の分解図を作成するステップと、前記コンピュータが前記分解図を出力手段に出力させるステップとをコンピュータに実行させるためのプログラムを記録したことを要旨とする。

【００１５】この発明によれば、製造対象物に関する部品の形状データと、分解図を作成するために必要な分解条件データとが記憶手段に記憶される。そして、分解図作成指令に応答して、形状データから作図される部品の配置位置を分解条件データを基に換えることで製造対象物に関する設計図面の分解図が作成され、その分解図が出力手段に出力される。従って、製造対象物に関する組立作業マニュアルを提供する際に分解図が自動で作成され、面倒な作図作業をすることなく簡単に分解図が得られる。

【００１６】
【発明の実施の形態】以下、本発明を具体化した分解図自動作成装置の一実施形態を図１～図１０に従って説明する。

【００１７】図１は、分解図自動作成装置の概略構成図である。分解図自動作成装置１は設計対象物となる製品の設計図面をＣＡＤにより作成するものである。分解図自動作成装置１は分解図作成手段としての制御装置２、入力装置３および出力手段としての出力装置４を備えている。制御装置２は入力装置３により入力された文字情報や図形の描画情報を基に製品に関する図面を作成し、その図面を出力装置４が適宜の形式で出力する。なお、制御装置２はＣＰＵ、ＲＯＭ、ＲＡＭ等からなり、入力装置３はキーボードやポインティングデバイス等からなり、出力装置４はディスプレイやプリンタ等からなる。

【００１８】分解図自動作成装置１は読取装置５を備え、記録媒体としてのＣＤ－ＲＯＭ６に書き込まれたプログラムとしての分解図自動作成用プログラムが、読取装置５によって読み取られてハードディスク（図示省略）にインストールされる。制御装置２は、この分解図自動作成用プログラムを基に製品の設計図面として組付図や分解図等のＣＡＤ図面を作成する。

【００１９】分解図自動作成装置１は、入力装置３を用いて入力した各種データが記憶される記憶手段としての部品形状データベース７とアッセンブリ構造データベース８とを備えている。部品形状データベース７には、製品の最小分解単位である部品の形状データ（３次元データ）が記憶されている。アッセンブリ構造データベース８には、各部品間同士の関係付けを決める各種データ（アッセンブリ構造データ、組付条件データ）が記憶されている。このアッセンブリ構造データは、所定の部品がどの組付先の部品に組み付けられるかを設定するものである。

【００２０】図２はディスプレイに表示される組付完成後の製品のＣＡＤ図面である。ＣＡＤ図面として作成された製品Ｍの組付図９は３次元ＣＡＤデータであり、製品Ｍの構成要件としてユーザにより入力された部品の形状データを基に作成される。つまり、各部品の形状データが所定の順序および位置に組み付けられることで図２に示す製品Ｍの組付図９が出来上がる。なお、製品Ｍの

CAD図面は視覚方向（●●方向）が自由に設定可能となっている。

【0021】また、製品Mは最上層の構成要件としてユニット10、ユニット11およびユニット12から構成され、ユニット10，12がユニット11に組み付けられることで一部品をなしている。このうちのユニット10は部品13〜23（合計11個）により構成され、これら部品13〜23を組み付けることで一部品をなしている。なお、ユニット11，12も複数の部品により組みつけられているが、ここではその構成を省略している。

【0022】次に、図2に示す製品の組付図9を作成するまでの手順を説明する。まず、設計用の図面として製品Mに関する部品の形状データを作成してゆき、この形状データ作成に並行してこれら部品に関するアッセンブリ構造データも入力する。本例では、図3に示す入力画面24をディスプレイに表示し、ツリー形式の構造データを作成することでアッセンブリ構造データの入力を行う。これにより、製品Mが一階層目として3つのユニット10〜12からなり、そのうちのユニット10が部品13〜23を構成要件としていると設定される。なお、形状データが部品形状データベース7に保存され、アッセンブリ構造データがアッセンブリ構造データベース8に保存される。

【0023】そして、入力画面24上で部品13〜23の各ボタン25をクリックすることにより、図4に示す入力画面26を各部品ごとにディスプレイに表示して部品と部品との間の組付条件データを入力してゆく。この入力画面26には組付位置（基準位置）の入力欄27と、組付方向（3次元方向）の入力欄28とが設けられている。なお、組付条件データが分解方向条件データに相当する。

【0024】ここで、組付条件データの入力について図5に示す例を用いて説明する。入力対象となる部品（図5では部品29）のどの位置が組付先の部品（図5では部品30）のどの位置に組み付けられるかを指定するために、入力欄27には部品29の組付点Rと部品30の組付点Sとが入力される。ここでは、部品30を基準として部品29が移動することにより部品29と部品30が組み付けられることになる。

【0025】また、部品29の部品30に対する組付方向を指定するために、入力欄28には部品29の組付方向（Ix，Iy，Iz）、つまり部品30への組付方向としてX，Y，Z軸に対する角度がそれぞれ入力される。そして、この組付条件データがアッセンブリ構造データベース8に保存される。なお、入力画面24で入力したアッセンブリ構造データと、これら入力欄27，28に入力された組付条件データとが分解条件データを構成する。

【0026】部品の形状データ、アッセンブリ構造デー

タ、組付条件デ●●●の入力が全ての部品で完了し、製品Mの組付図作成モードが実行されると、制御装置2はアッセンブリ構造データと組付条件データから決まる組付手順で部品を組み付け、図2に示す製品Mの組付図9を作成する。つまり、まず最初に最下位層である部品13〜23を組み付けることで各ユニット10〜12をそれぞれ個々に作成し、次の段階でこれらユニット10〜12を組み付けて図2に示す組付図9が作成される。

【0027】次に、図2に示す製品Mの組付図9から分解図を作成するまでの手順を説明する。まず、製品Mの組付図であるCAD図面の見る方向（角度）を指定する。ここでは、図6に示すようにZ軸を基準として約30度傾斜させた斜視図31を見る方向として指定している。なお、この見る方向の指定時には分解時の各部品間の離れ距離も指定する。

【0028】これらの指定処理後、分解対象を指定する処理を行う。つまり、分解対象指定時には図6に示す表示画面32に「ALL」ボタン33と「UNIT」ボタン34とが表示される。2つのボタンのうち「ALL」ボタン33がクリックされると製品全体が分解対象となる。一方、分解図を作成したいユニットをディスプレイ上でクリックした状態で「ユニット」ボタン34がクリックされると、その指定したユニットが分解対象となる。本例では、図7に示すようにユニット10が分解対象として指定され、表示画面32にはユニット10のみがピックアップして表示される。

【0029】この指定処理後、図7に示す表示画面32には「全て」ボタン35と「一階層」ボタン36とが表示される。2つのボタンのうち「全て」ボタン35がクリックされると、制御装置2は分解対象を最小構成単位である部品単位にまで分解した分解図を作成する。一方、「一階層」ボタン36がクリックされると、制御装置2はその分解対象のうち一階層目まで分解された分解図を作成する。なお、本例ではユニット10の下位層が最下位層となっているため、「全て」ボタン35と「一階層」ボタン36のどちらを選んでも同じ分解図が作成される。そして、最終的な分解図として図8に示す分解図37が表示画面32に表示される。

【0030】つまり、制御装置2はアッセンブリ構造データと組付条件データを基に、ディスプレイ上に表示された部品の配置位置を換えることによって分解図37を作成する。詳述すると、移動対象となる部品（図5では部品29）を基準となる部品（図5では部品30）に対し組付方向と反する方向（分解方向）に移動させる処理を各部品ごとに行って分解図37が作成される。本例の分解図37は、部品14〜20が部品13に対して＋Z方向に移動し、部品21，22が部品20に対して＋Z方向に移動し、部品23が部品13に対して＋X方向に移動することによって作成される。ちなみに、製品MのCAD図面を見る方向として側面図を指定した場合に

は、図9に示すような■■図38が作成される。

【0031】次に、分解図を作成するときに制御装置2が分解図作成用プログラムに沿って実行する手順を図10に示すフローチャートに従って説明する。まず、ステップ（以下、単にSと記す）100では、部品の形状データを取り込む。即ち、ユーザによって入力された部品に関する形状データを部品形状データベース7から取り込む。

【0032】S110では、アッセンブリ構造データを取り込む。即ち、ユーザによって指定された各部品間の関係を示すアッセンブリ構造データをアッセンブリ構造データベース8から取り込む。

【0033】S120では、組付条件を取り込む。即ち、ユーザによって指定された部品と部品の間の関係付けを示す組付条件データをアッセンブリ構造データベース8から取り込む。

【0034】S130では、分解図作成指令を入力する。即ち、図面作成モードが分解図作成モードに設定される。S140では、分解図の見る方向を指定する。即ち、ユーザにディスプレイ上の組付図の見る方向を指定させることで、最終的に出来上がる分解図をどの角度で見るかが設定される。

【0035】S150では、分解対象の指定をする。即ち、ディスプレイ上に表示される「ALL」ボタン33が選択された場合には製品全体が、「UNIT」ボタン34が選択された場合にはユニットが分解対象として指定される。その次の段階で、ディスプレイ上に表示される「全て」ボタン35が選択された場合にはその分解対象全てが、「一階層」ボタン36が選択された場合には選択対象の一階層目までが分解対象として指定される。

【0036】S160では、分解図作成処理を実行する。即ち、アッセンブリ構造データと組付条件データを基にして、その組付条件データから決まる配置位置へ各部品を移動させることで分解図37を作成する。

【0037】S170では、出力装置4への表示処理を実行する。即ち、分解図37がディスプレイに表示されたり、プリンタから印刷出力される。そして、ユーザは必要に応じて入力装置3を操作して部品を所望の位置へ配置変更したり、部品に関する説明文を記述したりする。

【0038】ところで、製品Mの組立作業に関して、その組立作業用のマニュアルを必要とする場合がある。本例では、制御装置2がアッセンブリ構造データの位置関係のもと、形状データから作図される部品を組付条件データに沿って組み立てていくことにより、CADデータを用いた組立作業用のマニュアルが作成可能となる。これにより、工場等の現場で製品Mを製造する作業者に対し、組立作業用マニュアルとして製品Mに関する組付手順の提供が行える。さらに、製品Mの設計図面が正確に作成されたか否かの設計確認も行える。

【0039】また■■製造現場等では製品Mの保守に関して、故障した部品を交換するために分解図を必要とする場合もある。本例では、制御装置2がアッセンブリ構造データと組付条件データを基にして、組付条件データから決まる分解方向に部品を移動させて部品の配置位置を換えることで分解図37を作成し、それを組立作業用のマニュアルとして作業者に提供する。従って、製品Mの設計図面に関する分解図37が自動で作成されることになり、部品交換時にユーザは簡単に分解図37が得られることになる。

【0040】従って、この実施形態では以下のような効果を得ることができる。

（1）製品Mの組立作業用のマニュアルとして、制御装置2がアッセンブリ構造データと組付条件データを基にして、形状データから作図される部品の配置位置を所定の分解方向に移動させることで分解図37が作成される。従って、作業者（ユーザ）はコンピュータ支援のもと分解図37を自動で作成でき、製品Mの保守に関して部品の交換等を行う場合に簡単に分解図37を得ることができる。

【0041】（2）制御装置2はアッセンブリ構造データの位置関係のもと、形状データから作図される部品を組付条件データに沿って組み立てていくことにより組立図9を作成する。従って、製品Mを製造する作業者に対し、コンピュータ支援のもと製品Mの組付手順を提供できる。これに加え、組立作業用のマニュアルを提供することで、作業者は製品Mの設計確認の作業も行うことができる。

【0042】（3）分解図37を作成するために必要なデータとして、製品Mを作図する際に用いられる組付条件データを使用している。よって、分解図37を作成する場合に、その分解図作成のために新たなデータを必要としない。また、組付条件データに組付方向として3次元方向を入力するので、分解図37を3次元対応のもので作図することができる。

【0043】（4）分解対象として製品Mの全体や各ユニット10〜12を選択する構成となっているので、分解対象を製品Mの全体や各ユニット10〜12の間で自由に設定でき、仕様に応じた分解図を作成できる。

【0044】なお、実施形態は前記に限定されず、例えば、次の態様に変更してもよい。

・　分解条件データはアッセンブリ構造データと組付条件データから構成されることに限定されず、設計図面に対する分解図を作成するために必要なデータであればその内容は特に問わない。例えば、分解方向として3次元の組付方向を入力したが、必要に応じて2次元または1次元であってもよい。

【0045】・　分解方向条件データは組付条件データに限らない。例えば、製品Mの分解図37を作成するために新たにデータを入力し、このときに入力したデータ

を分解方向条件データ●●●●てもよい。

【0046】・　組付条件として指定する組付条件データは図4に示す入力画面26に入力するデータに限定されず、分解図37を作成するために必要なものであればそのデータ内容は問わない。

【0047】・　アッセンブリ構造データや組付条件データの入力形式は本例の形態に限定されない。このうち、アッセンブリ構造データはツリー形式で入力するのではなく、例えば部品の形状データの入力に並行して、その形状データにアッセンブリ構造データを付加することによりデータ入力を行うようにしてもよい。また、組付条件データも入力画面26を開く形態ではなく、同様に形状データの入力に並行して行うものでもよい。

【0048】・　分解対象は製品M全体またはユニット単体であることに限定されない。例えば、制御装置2はユーザに対して分解させたい部品を指定させ、その指定された部品のみがピックアップして分解された分解図を作成するようにしてもよい。

【0049】・　設計図面を作図するシステムはCADシステムに限らず、コンピュータ支援のもと図面設計ができるものであれば、システム形式は自由に選択してもよい。

【0050】・　記録媒体はCD-ROM6に限定されず、例えばフロッピー（登録商標）ディスクやメモリカード等の他の媒体を用いてもよい。

・　設計図面の対象物は本例のような製品Mに限定されず、自動車部品、電気製品、工作機械、玩具など多種多様な製品の設計図面を作成するときに、本例の分解図自動作成装置1を利用できる。

【0051】前記実施形態及び別例から把握できる技術的思想について、以下にその効果とともに記載する。

（1）請求項1～3において、前記分解条件データは各部品間の取り付け位置を指定した位置条件と、分解方向として3次元方向を指定した分解方向条件とを有し、前記分解図作成手段はこれら条件を基に前記部品を分解方向条件から決まる3次元方向に移動させることで、該部品の配置位置を換えて前記分解図を作成する。この場合、3次元に対応した分解図を作成できる。

【0052】（2）請求項1～3、前記技術的思想
（1）において、前記分解図作成手段は分解対象の指定に応じて、前記製造対象物の全体又は該製造対象物のユニットの各単位で前記分解図を作成する。この場合、必要に応じて製造対象物の全体の分解図やユニットの分解図を作成でき、仕様に応じた分解図を作成できる。

【0053】（3）請求項4において、前記分解条件データは各部品間の関係を示すアッセンブリ構造データと、分解時の部品の移動方向を示す分解方向条件データとからなり、前記アッセンブリ構造データと分解方向条件データとを基に、該分解方向条件データから決まる分

解方向へ前記部●●●●配置位置を換えることで前記分解図が作成される。この場合、請求項2と同様の効果が得られる。

【0054】（4）請求項4において、前記分解方向条件データは前記設計図面の組付図を作成するときに部品を組み付けるための組付条件として入力する組付条件データであり、前記組付条件データを基に前記部品の配置位置を換えることで前記分解図が作成される。この場合、請求項3と同様の効果が得られる。

【0055】（5）請求項5において、前記分解条件データは各部品間の関係を示すアッセンブリ構造データと、分解時の部品の移動方向を示す分解方向条件データとからなり、分解図を作成する前記ステップでは、アッセンブリ構造データと分解方向条件データとを基に、該分解方向条件データから決まる分解方向へ前記部品の配置位置を換えることで前記分解図が作成される。この場合、請求項2と同様の効果が得られる。

【0056】（6）請求項5において、前記分解方向条件データは前記設計図面の組付図を作成するときに部品を組み付けるための組付条件として入力する組付条件データであり、分解図を作成する前記ステップでは、前記組付条件データを基に、前記部品の配置位置を換えることで前記分解図が作成される。この場合、請求項3と同様の効果が得られる。

【0057】
【発明の効果】以上詳述したように本発明によれば、設計対象物に対する設計図面を提供する際に、簡単に分解図を作成することができる。

【図面の簡単な説明】
【図1】　一実施形態における分解図自動作成装置の概略構成図。
【図2】　ディスプレイに表示される組付完成後の製品のCAD図面。
【図3】　アッセンブリ構造データの入力画面図。
【図4】　組付条件データの入力画面図。
【図5】　組付条件データについての説明図。
【図6】　製品の組付図が表示された画面図。
【図7】　一つのユニットが指定表示された画面図。
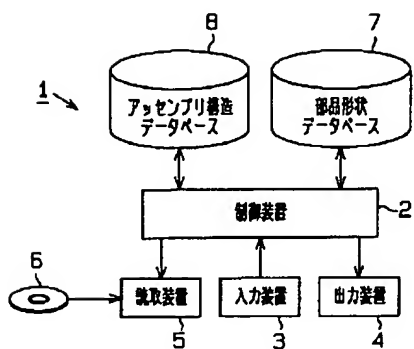【図8】　ユニットの分解図が表示された画面図。
【図9】　ユニットの分解図が表示された他の画面図。
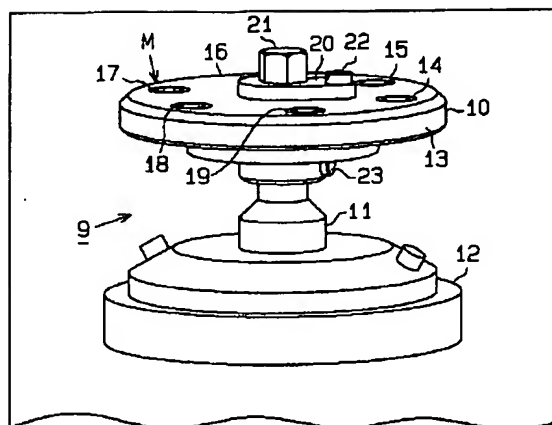【図10】　分解図作成時に実行されるフローチャート。
【符号の説明】
1…分解図自動作成装置、2…分解図作成手段としての制御装置、4…出力手段としての出力装置、6…記録媒体としてのCD-ROM、7…記憶手段としての部品形状データベース、8…記憶手段としてのアッセンブリ構造データベース、9…組付図、13～21…部品、37，38…分解図、M…製造対象物としての製品。
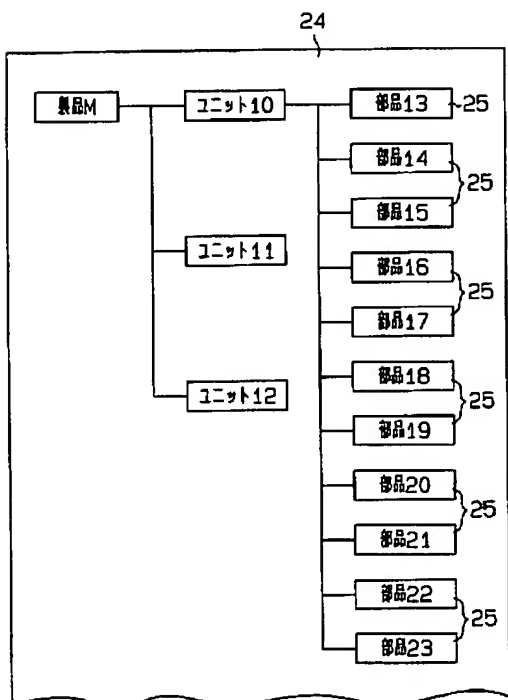
【図1】

【図2】
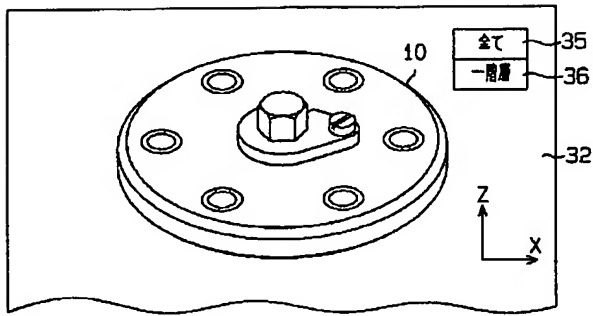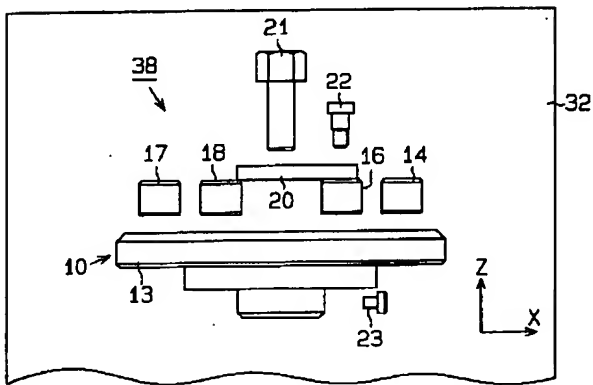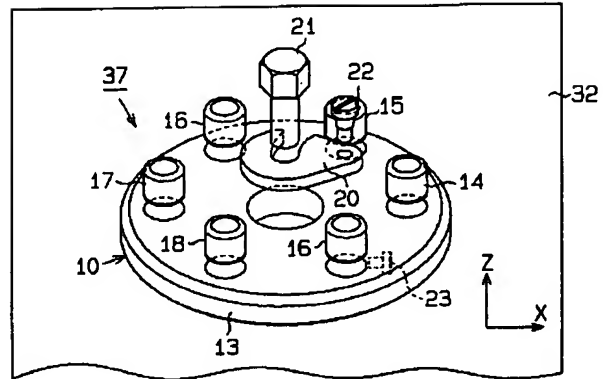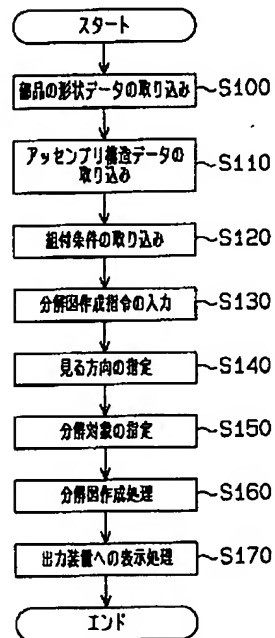
【図3】

【図4】

【図5】

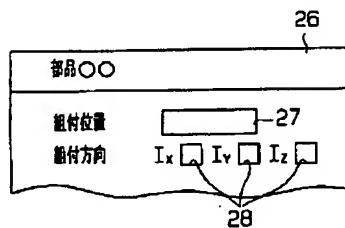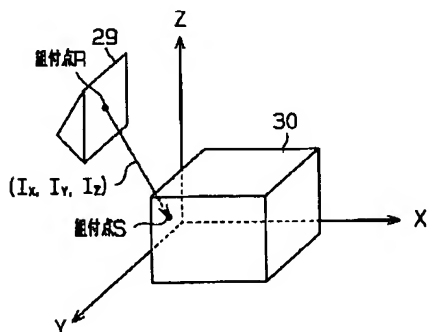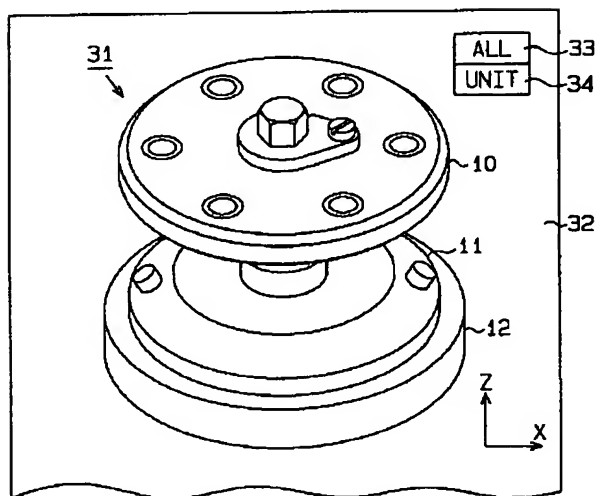

【図6】

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【図7】

全て	35
一階層	36

【図8】

【図9】

【図10】

スタート

部品の形状データの取り込み — S100

アッセンブリ構造データの取り込み — S110

組付条件の取り込み — S120

分解図作成指令の入力 — S130

見る方向の指定 — S140

分解対象の指定 — S150

分解図作成処理 — S160

出力装置への表示処理 — S170

エンド

-8-

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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] The configuration data of the components are the exploded view automatic listing device which creates the design drawing about a manufacture object on the basis of computer exchange, and concerning said manufacture object, A storage means to memorize decomposition condition data required in order to create an exploded view, The exploded view automatic listing device characterized by having an exploded view creation means to create the exploded view of said design drawing by changing the arrangement location of the components plotted from said configuration data based on said decomposition condition data.
[Claim 2] It is the exploded view automatic listing device according to claim 1 which said decomposition condition data consist of assembly structure data in which the relation between each part articles is shown, and decomposition direction condition data in which the migration direction of the components at the time of decomposition is shown, and is characterized by for said exploded view creation means to create said exploded view by changing the arrangement location of said component in the decomposition direction decided from these decomposition direction condition data based on assembly structure data and decomposition direction condition data.
[Claim 3] It is the exploded view automatic listing device according to claim 2 characterized by for said decomposition direction condition data being condition data with a group inputted as conditions with a group for attaching components when creating the group attached chart of said design drawing, and said exploded view creation means creating said exploded view by changing the arrangement location of said component based on said condition data with a group.
[Claim 4] The configuration data of the components are the exploded view automatic creation approach which creates the design drawing about a manufacture object on the basis of computer exchange, and concerning said manufacture object, Decomposition condition data required in order to create an exploded view are memorized by the storage means, and an exploded view creation means carries out based on said decomposition condition data. The exploded view automatic creation approach characterized by creating the exploded view of said design drawing by changing the arrangement location of the components plotted from said configuration data.
[Claim 5] The step with which incorporate the configuration data of the components about a manufacture object, and decomposition condition data required in order to create an exploded view, and a computer remembers them to be for a storage means, The step which creates the exploded view of the design drawing about said manufacture object by changing the arrangement location of the components with which an exploded view creation command is answered and said computer is plotted from said configuration data based on said decomposition condition data, The record medium which recorded the program for making a computer perform the step which said computer makes output said exploded view to an output means and in which computer reading is possible.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to an exploded view automatic listing device, the exploded view automatic creation approach, and its record medium.
[0002]
[Description of the Prior Art] In designing products (components), such as autoparts, in recent years, CAD which is a design system with computer exchange is used widely. as compared with the design of the product on the space till then, retrieval and reuse of the past data with easy processing and correction of data with which a simulation becomes possible are easy for the design of the product using this CAD system -- etc. -- there are many advantages.
[0003]
[Problem(s) to be Solved by the Invention] By the way, the manual in which the assembly procedure at the time of assembling components is shown may be created based on the CAD data created using the CAD system. As for the design which used the CAD system, being performed by the independent engine is [this manual preparation activity] common, and each engine is creating the manual based on CAD data uniquely in the present condition.
[0004] Although the exploded view needed to be put on this manual in order to explain the assembly of components gradually, the present condition was creating that exploded view manually based on CAD data. Therefore, manual preparation, i.e., exploded view creation, took time and effort very much, and the problem of exploded view creation tending to generate a mistake on trouble, long-duration-izing of exploded view creation, and an exploded view had arisen.
[0005] This invention is made in view of the aforementioned trouble, and the purpose is in offering the exploded view automatic listing device which can create an exploded view easily, the exploded view automatic creation approach, and its record medium.
[0006]
[Means for Solving the Problem] In order to solve the above-mentioned trouble, in invention according to claim 1 The configuration data of the components are the exploded view automatic listing device which creates the design drawing about a manufacture object on the basis of computer exchange, and concerning said manufacture object, Let it be a summary to have had an exploded view creation means to create the exploded view of said design drawing by changing the arrangement location of the components plotted from said configuration data a storage means to memorize decomposition condition data required in order to create an exploded view, and based on said decomposition condition data.
[0007] According to this invention, an exploded view creation means creates the exploded view about a design drawing by changing the arrangement location of the. components plotted from configuration data based on the decomposition condition data memorized by the storage means. Therefore, an exploded view is obtained simply, without creating an exploded view automatically and doing a troublesome plot activity, in case the assembly-operation manual about a manufacture object is offered.
[0008] The assembly structure data which said decomposition condition data show the relation between each

part articles in invention according to claim 1 by invention according to claim 2, Consisting of decomposition direction condition data in which the migration direction of the components at the time of decomposition is shown, said exploded view creation means makes it a summary to create said exploded view by changing the arrangement location of said component based on assembly structure data and the decomposition direction condition data in the decomposition direction decided from these decomposition direction condition data.

[0009] According to this invention, in addition to an operation of invention according to claim 1, exploded view creation is performed by changing the arrangement location of components in the decomposition direction where an exploded view creation means is decided from the decomposition direction condition data based on assembly structure data and the decomposition direction condition data.

[0010] In invention according to claim 3, in invention according to claim 2, said decomposition direction condition data are condition data with a group inputted as conditions with a group for attaching components, when creating the group attached chart of said design drawing, and said exploded view creation means makes it a summary to create said exploded view by changing the arrangement location of said component based on said condition data with a group.

[0011] According to this invention, in addition to an operation of invention according to claim 2, an exploded view creation means creates an exploded view by changing the arrangement location of components based on the condition data with a group inputted as conditions with a group, when creating the group attached chart of a design drawing. Therefore, since exploded view creation is performed based on condition data with a group, the new data for exploded view creation are not needed, and it is not necessary to newly input the data about exploded view creation.

[0012] By invention according to claim 4 Configuration data of the components are the exploded view automatic creation approach which creates the design drawing about a manufacture object on the basis of computer exchange, and concerning said manufacture object, Decomposition condition data required in order to create an exploded view are memorized by the storage means, and let it be a summary to create the exploded view of said design drawing by changing the arrangement location of the components with which an exploded view creation means is plotted from said configuration data based on said decomposition condition data.

[0013] According to this invention, the configuration data of the components about a manufacture object and decomposition condition data required in order to create an exploded view are memorized by the storage means. And an exploded view is plotted by changing the arrangement location of the components with which an exploded view creation means is plotted from configuration data using these data based on decomposition condition data. Therefore, an exploded view is obtained simply, without creating an exploded view automatically and doing a troublesome plot activity, in case the assembly-operation manual about a manufacture object is offered.

[0014] The configuration data of the components concerning a manufacture object by invention according to claim 5, The step with which incorporate decomposition condition data required in order to create an exploded view, and a computer remembers them to be for a storage means, The step which creates the exploded view of the design drawing about said manufacture object by changing the arrangement location of the components with which an exploded view creation command is answered and said computer is plotted from said configuration data based on said decomposition condition data, Let it be a summary to have recorded the program for making a computer perform the step which said computer makes output said exploded view to an output means.

[0015] According to this invention, the configuration data of the components about a manufacture object and decomposition condition data required in order to create an exploded view are memorized by the storage means. And an exploded view creation command is answered, the exploded view of the design drawing about a manufacture object is created by changing the arrangement location of the components plotted from configuration data based on decomposition condition data, and the exploded view is outputted to an output means. Therefore, an exploded view is obtained simply, without creating an exploded view automatically and doing a troublesome plot activity, in case the assembly-operation manual about a manufacture object is offered.

[0016]
[Embodiment of the Invention] Hereafter, 1 operation gestalt of the exploded view automatic listing device which materialized this invention is explained according to drawing 1 - drawing 10 .

[0017] Drawing 1 is the outline block diagram of an exploded view automatic listing device. The exploded view automatic listing device 1 creates the design drawing of the product used as a design object by CAD. The exploded view automatic listing device 1 is equipped with the control unit 2 as an exploded view creation means, the input unit 3, and the output unit 4 as an output means. A control unit 2 creates the drawing about a product based on the text and the drawing information on a graphic form that it was inputted by the input unit 3, and outputs the drawing to it in the format that an output unit 4 is proper. In addition, a control device 2 consists of CPU, a ROM, RAM, etc., an input device 3 consists of a keyboard, a pointing device, etc., and an output unit 4 consists of a display, a printer, etc.

[0018] The exploded view automatic listing device 1 is equipped with a reader 5, and the program for exploded view automatic creation as a program written in CD-ROM6 as a record medium is read by the reader 5, and it is installed on a hard disk (illustration abbreviation). A control unit 2 creates CAD drawings, such as a group attached chart and an exploded view, as a design drawing of a product based on this program for exploded view automatic creation.

[0019] The exploded view automatic listing device 1 is equipped with the part-shape database 7 and the assembly structure database 8 as a storage means by which the various data inputted using the input device 3 are memorized. The configuration data (three-dimension data) of the components which are the minimum decomposition units of a product are memorized by the part-shape database 7. The various data (assembly structure data, condition data with a group) which decide relating between each part articles to be the assembly structure database 8 are memorized. This assembly structure data sets up whether predetermined components are attached to the components of which point with a group.

[0020] Drawing 2 is the CAD drawing of the product after the completion with a group displayed on a display. The group attached chart 9 of the product M created as a CAD drawing is three-dimensional-CAD data, and is created based on the configuration data of the components inputted by the user as requirements for a configuration of Product M. That is, the group attached chart 9 of the product M shown in drawing 2 by the configuration data of each part article being attached to predetermined sequence and a predetermined location is done. In addition, the direction of vision (direction to see) can set up the CAD drawing of Product M freely.

[0021] Moreover, Product M consists of a unit 10, a unit 11, and a unit 12 as requirements for a configuration of the maximum upper layer, and elegance is made in part by units 10 and 12 being attached to a unit 11. The unit 10 of these is constituted by components 13-23 (a total of 11 pieces), and elegance is made in part by attaching these components 13-23. In addition, although units 11 and 12 are also constructed with two or more components, the configuration is omitted here.

[0022] Next, a procedure until it creates the group attached chart 9 of the product shown in drawing 2 is explained. First, the configuration data of the components about Product M are created as a drawing for a design, and the assembly structure data about these components are also inputted in parallel to this configuration data origination. By this example, the input screen 24 shown in drawing 3 is displayed on a display, and an assembly structure entry of data is performed by creating the structure data of a tree format. Thereby, Product M consists of three units 10-12 as a ground-floor layer, and it will be set up if the unit 10 of them makes components 13-23 the requirements for a configuration. In addition, configuration data are saved in the part-shape database 7, and assembly structure data are saved in the assembly structure database 8.

[0023] And by clicking each carbon button 25 of components 13-23 on an input screen 24, the input screen 26 shown in drawing 4 is displayed on a display for every each part article, and the condition data with a group between components are inputted. The input column 27 of a location with a group (criteria location) and the input column 28 of a direction with a group (the direction of a three dimension) are formed in this input screen 26. In addition, condition data with a group are equivalent to the decomposition direction condition data.

[0024] Here, a condition entry of data with a group is explained using the example shown in drawing 5 R> 5. In order to specify whether the location of the components (drawing 5 R> 5 components 29) throat used as the

candidate for an input is attached to the location of the components (drawing 5 components 30) throat of the point with a group, ****** R of components 29 and ****** S of components 30 are inputted into the input column 27. Here, when components 29 move on the basis of components 30, components 29 and components 30 will be attached.

[0025] Moreover, as the direction with a group of components 30 of components 29 (Ix, Iy, Iz), i.e., a direction with a group, in order to specify the direction with a group over the components 30 of components 29, the include angle to X, Y, and the Z-axis is inputted into the input column 28, respectively. And this condition data with a group is saved in the assembly structure database 8. In addition, the assembly structure data inputted by the input screen 24 and the condition data with a group inputted into these input columns 27 and 28 constitute decomposition condition data.

[0026] If the configuration data of components, assembly structure data, and a condition entry of data with a group are completed with all components and group attached chart creation mode of Product M is performed, a control device 2 will attach components in the procedure with a group decided from assembly structure data and condition data with a group, and will create the group attached chart 9 of the product M shown in drawing 2 . That is, each units 10-12 are separately created by attaching the components 13-23 which are the lowest layers first, respectively, and the group attached chart 9 which attaches these units 10-12 in the next phase, and is shown in drawing 2 is created.

[0027] Next, a procedure until it creates an exploded view from the group attached chart 9 of the product M shown in drawing 2 is explained. First, the direction (include angle) which the CAD drawing which is the group attached chart of Product M looks at is specified. Here, it specifies as a direction which looks at the perspective view 31 made to incline about 30 degrees on the basis of the Z-axis as shown in drawing 6 . In addition, at the time of assignment of this direction to see, the detached building distance between each part articles at the time of decomposition is also specified.

[0028] Processing which specifies the candidate for decomposition is performed after these assignment processings. That is, the "ALL" carbon button 33 and the "UNIT" carbon button 34 are displayed on the display screen 32 shown in drawing 6 at the time of the assignment for decomposition. If the "ALL" carbon button 33 is clicked between two carbon buttons, the whole product will serve as a candidate for decomposition. If the "unit" carbon button 34 is clicked where the unit which wants to create an exploded view is clicked on a display on the other hand, the specified unit will serve as a candidate for decomposition. In this example, as shown in drawing 7 , a unit 10 is specified as a candidate for decomposition, and only a unit 10 is taken up and displayed on the display screen 32.

[0029] A carbon button 35 and the "ground-floor layer" carbon button 36 are "altogether" displayed on the display screen 32 shown in drawing 7 after this assignment processing. If a carbon button 35 is "altogether" clicked between two carbon buttons, a control unit 2 will create the exploded view which decomposed the candidate for decomposition even into the components unit which is a minimum configuration unit. On the other hand, if the "ground-floor layer" carbon button 36 is clicked, a control unit 2 will create the exploded view disassembled to a ground-floor layer in for [the] decomposition. In addition, in this example, since the lower layer of a unit 10 is the lowest layer, whichever it chooses [of a carbon button 35 and the "ground-floor layer" carbon button 36] "altogether", the same exploded view is created. And decomposition drawing 37 shown in drawing 8 as a final exploded view is displayed on the display screen 32.

[0030] That is, a control device 2 creates decomposition drawing 37 by changing the arrangement location of the components displayed on the display based on assembly structure data and condition data with a group. If it explains in full detail, processing which moves the components (drawing 5 components 29) used as the candidate for migration in a direction with a group and the contrary direction (the decomposition direction) to the components (drawing 5 components 30) used as criteria will be performed for every each part article, and decomposition drawing 37 will be created. Decomposition drawing 37 of this example is created, when components 14-20 move to + Z direction to components 13, components 21 and 22 move to + Z direction to components 20 and components 23 move in the direction of +X to components 13. When a side elevation is incidentally specified as a direction which looks at the CAD drawing of Product M, decomposition drawing 38 as shown in drawing 9 is created.

[0031] Next, when creating an exploded view, the procedure which a control unit 2 performs in accordance with the program for exploded view creation is explained according to the flow chart shown in drawing 10 R> 0. First, the configuration data of components are incorporated at step (it is only hereafter described as S) 100. That is, the configuration data about the components inputted by the user are incorporated from the part-shape database 7.

[0032] Assembly structure data are incorporated in S110. That is, the assembly structure data in which the relation between each part articles specified by the user is shown are incorporated from the assembly structure database 8.

[0033] Conditions with a group are incorporated in S120. That is, the condition data with a group in which relating between the components and components which were specified by the user is shown are incorporated from the assembly structure database 8.

[0034] An exploded view creation command is inputted in S130. That is, drawing creation mode is set as exploded view creation mode. The direction which an exploded view looks at is specified in S140. That is, it is set up by making a user specify the direction which the group attached chart on a display looks at at which include angle the exploded view finally done is obtained.

[0035] The candidate for decomposition is specified in S150. That is, when the "ALL" carbon button 33 displayed on a display is chosen and the "UNIT" carbon button 34 is chosen for the whole product, a unit is specified as a candidate for decomposition. When a carbon button 35 is chosen "altogether" and the "ground-floor layer" carbon button 36 is chosen [which was displayed on the display] for all the candidates for decomposition in the next phase, even eye a ground-floor layer for selection is specified as a candidate for decomposition.

[0036] Exploded view creation processing is performed in S160. That is, decomposition drawing 37 is created by moving each part article to the arrangement location decided from the condition data with a group based on assembly structure data and condition data with a group.

[0037] In S170, display processing to an output unit 4 is performed. That is, decomposition drawing 37 is displayed on a display, or a printout is carried out from a printer. And a user operates an input unit 3 if needed, and an arrangement change of the components is made to a desired location, or he describes the explanatory note about components.

[0038] By the way, the manual for the assembly operation may be needed about the assembly operation of Product M. In this example, when the control device 2 assembles the components plotted from the basis of the physical relationship of assembly structure data, and configuration data along with condition data with a group, creation of the manual for assembly operation using CAD data is attained. Thereby, the procedure with a group about Product M can be offered as a manual for assembly operation to the operator who manufactures Product M in sites, such as works. Furthermore, the design check of whether the design drawing of Product M was created correctly can also be performed.

[0039] Moreover, in a manufacture site, in order to exchange the broken components about maintenance of Product M, an exploded view may be needed. In this example, decomposition drawing 37 is created by moving components in the decomposition direction in which a control device 2 is decided from condition data with a group based on assembly structure data and condition data with a group, and changing the arrangement location of components, and an operator is provided with it as a manual for assembly operation. Therefore, decomposition drawing 37 about the design drawing of Product M will be created automatically, and, as for a user, decomposition drawing 37 will be simply obtained at the time of a parts replacement.

[0040] Therefore, the following effectiveness can be acquired with this operation gestalt.

(1) Decomposition drawing 37 is created by moving the arrangement location of the components with which a control device 2 is plotted from configuration data based on assembly structure data and condition data with a group in the predetermined decomposition direction as a manual for the assembly operation of Product M. therefore, an operator (user) ― the basis of computer exchange ― decomposition drawing 37 can be created automatically, and when performing exchange of components etc. about maintenance of Product M, decomposition drawing 37 can be obtained easily.

[0041] (2) A control device 2 creates assembly drawing 9 by assembling the components plotted from the

basis of the physical relationship of assembly structure data, and configuration data along with condition data with a group. Therefore, the procedure with a group of Product M can be offered also as that of computer exchange to the operator who manufactures Product M. In addition, an operator can also do the activity of a design check of Product M by offering the manual for assembly operation.

[0042] (3) The condition data with a group used as data required in order to create decomposition drawing 37 in case Product M is plotted are used. Therefore, when creating decomposition drawing 37, data new for the exploded view creation are not needed. Moreover, since the direction of a three dimension is inputted into condition data with a group as a direction with a group, it is the thing of three-dimension correspondence and decomposition drawing 37 can be plotted.

[0043] (4) Since it has composition which chooses the whole product M and each units 10-12 as a candidate for decomposition, the candidate for decomposition can be freely set up between the whole product M or each units 10-12, and the exploded view according to a specification can be created.

[0044] In addition, an operation gestalt is not limited above, for example, may be changed into the following mode.

− It is not limited to decomposition condition data consisting of assembly structure data and condition data with a group, and if it is data required in order to create the exploded view to a design drawing, especially the contents will not be asked. For example, although the direction with a group of a three dimension was inputted as a decomposition direction, you may be two-dimensional or one dimension if needed.

[0045] − The decomposition direction condition data are not restricted to condition data with a group. For example, it is good also considering the data which newly inputted data in order to create decomposition drawing 37 of Product M, and were inputted at this time as decomposition direction condition data.

[0046] − If the condition data with a group specified as conditions with a group are required in order not to be limited to the data inputted into the input screen 26 shown in drawing 4 but to create decomposition drawing 37, the contents of data will not be asked.

[0047] − Neither assembly structure data nor the condition entry-of-data format with a group is limited to the gestalt of this example. Among these, it may be made to perform a data input by adding assembly structure data to the configuration data in parallel to the configuration entry of data of components rather than inputting [for example,] assembly structure data in a tree format. Moreover, not the gestalt that opens an input screen 26 but the thing similarly performed in parallel to a configuration entry of data is sufficient also as condition data with a group.

[0048] − It is not limited to the candidate for decomposition being the whole product M or a unit simple substance. For example, a control unit 2 makes components to make it disassemble to a user specify, and you may make it create the exploded view where only the specified component was disassembled by taking up.

[0049] − As long as a drawing design can do the system which plots a design drawing not only as a CAD system but as that of computer exchange, a system format may be chosen freely.

[0050] − A record medium is not limited to CD-ROM6, for example, may use other media, such as a floppy (trademark) disk and a memory card.

− The object of a design drawing can use the exploded view automatic listing device 1 of this example, when it is not limited to a product M like this example but the design drawing of a variety of products, such as autoparts, an electric product, a machine tool, and a toy, is created.

[0051] The technical thought which can be grasped from said operation gestalt and example of another is indicated with the effectiveness below.

(1) Said decomposition condition data have the location conditions which specified the installation location between each part articles, and the decomposition direction conditions specified the direction of a three dimension as a decomposition direction, and it is moving said component based on these conditions in the direction of a three dimension decided from the decomposition direction conditions, and said exploded view creation means changes the arrangement location of these components, and creates said exploded view in claims 1-3. In this case, the exploded view corresponding to a three dimension can be created.

[0052] (2) In claims 1-3 and said technical thought (1), said exploded view creation means creates said exploded view per each [of the unit of said whole manufacture object or this manufacture object] according

to assignment for decomposition. In this case, the exploded view of the whole manufacture object and the exploded view of a unit can be created if needed, and the exploded view according to a specification can be created.

[0053] (3) Said decomposition condition data consist of assembly structure data in which the relation between each part articles is shown, and decomposition direction condition data in which the migration direction of the components at the time of decomposition is shown, and said exploded view is created in claim 4 by changing the arrangement location of said component in the decomposition direction decided from these decomposition direction condition data based on said assembly structure data and the decomposition direction condition data. In this case, the same effectiveness as claim 2 is acquired.

[0054] (4) In claim 4, said decomposition direction condition data are condition data with a group inputted as conditions with a group for attaching components, when creating the group attached chart of said design drawing, and said exploded view is created by changing the arrangement location of said component based on said condition data with a group. In this case, the same effectiveness as claim 3 is acquired.

[0055] (5) Said decomposition condition data consist of assembly structure data in which the relation between each part articles is shown, and decomposition direction condition data in which the migration direction of the components at the time of decomposition is shown, and said exploded view is created in claim 5 at said step which creates an exploded view by changing the arrangement location of said component based on assembly structure data and decomposition direction condition data in the decomposition direction decided from these decomposition direction condition data. In this case, the same effectiveness as claim 2 is acquired.

[0056] (6) In claim 5, said decomposition direction condition data are condition data with a group inputted as conditions with a group for attaching components, when creating the group attached chart of said design drawing, and at said step which creates an exploded view, said exploded view is created by changing the arrangement location of said component based on said condition data with a group. In this case, the same effectiveness as claim 3 is acquired.

[0057]
[Effect of the Invention] As explained in full detail above, in case the design drawing to a design object is offered according to this invention, an exploded view can be created easily.

[Translation done.]

* NOTICES *

TECHNICAL FIELD

[Field of the Invention] This invention relates to an exploded view automatic listing device, the exploded view automatic creation approach, and its record medium.

[Translation done.]

PRIOR ART

[Description of the Prior Art] In designing products (components), such as autoparts, in recent years, CAD which is a design system with computer exchange is used widely. as compared with the design of the product on the space till then, retrieval and reuse of the past data with easy processing and correction of data with which a simulation becomes possible are easy for the design of the product using this CAD system -- etc. -- there are many advantages.

[Translation done.]

* NOTICES *

EFFECT OF THE INVENTION

[Effect of the Invention] As explained in full detail above, in case the design drawing to a design object is offered according to this invention, an exploded view can be created easily.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, the manual in which the assembly procedure at the time of assembling components is shown may be created based on the CAD data created using the CAD system. As for the design which used the CAD system, being performed by the independent engine is [this manual preparation activity] common, and each engine is creating the manual based on CAD data uniquely in the present condition.
[0004] Although the exploded view needed to be put on this manual in order to explain the assembly of components gradually, the present condition was creating that exploded view manually based on CAD data. Therefore, manual preparation, i.e., exploded view creation, took time and effort very much, and the problem of exploded view creation tending to generate a mistake on trouble, long-duration-izing of exploded view creation, and an exploded view had arisen.
[0005] This invention is made in view of the aforementioned trouble, and the purpose is in offering the exploded view automatic listing device which can create an exploded view easily, the exploded view automatic creation approach, and its record medium.

[Translation done.]

* NOTICES *

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damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] In order to solve the above-mentioned trouble, in invention according to claim 1 The configuration data of the components are the exploded view automatic listing device which creates the design drawing about a manufacture object on the basis of computer exchange, and concerning said manufacture object, Let it be a summary to have had an exploded view creation means to create the exploded view of said design drawing by changing the arrangement location of the components plotted from said configuration data a storage means to memorize decomposition condition data required in order to create an exploded view, and based on said decomposition condition data.

[0007] According to this invention, an exploded view creation means creates the exploded view about a design drawing by changing the arrangement location of the components plotted from configuration data based on the decomposition condition data memorized by the storage means. Therefore, an exploded view is obtained simply, without creating an exploded view automatically and doing a troublesome plot activity, in case the assembly-operation manual about a manufacture object is offered.

[0008] The assembly structure data which said decomposition condition data show the relation between each part articles in invention according to claim 1 by invention according to claim 2, Consisting of decomposition direction condition data in which the migration direction of the components at the time of decomposition is shown, said exploded view creation means makes it a summary to create said exploded view by changing the arrangement location of said component based on assembly structure data and the decomposition direction condition data in the decomposition direction decided from these decomposition direction condition data.

[0009] According to this invention, in addition to an operation of invention according to claim 1, exploded view creation is performed by changing the arrangement location of components in the decomposition direction where an exploded view creation means is decided from the decomposition direction condition data based on assembly structure data and the decomposition direction condition data.

[0010] In invention according to claim 3, in invention according to claim 2, said decomposition direction condition data are condition data with a group inputted as conditions with a group for attaching components, when creating the group attached chart of said design drawing, and said exploded view creation means makes it a summary to create said exploded view by changing the arrangement location of said component based on said condition data with a group.

[0011] According to this invention, in addition to an operation of invention according to claim 2, an exploded view creation means creates an exploded view by changing the arrangement location of components based on the condition data with a group inputted as conditions with a group, when creating the group attached chart of a design drawing. Therefore, since exploded view creation is performed based on condition data with a group, the new data for exploded view creation are not needed, and it is not necessary to newly input the data about exploded view creation.

[0012] By invention according to claim 4 Configuration data of the components are the exploded view automatic creation approach which creates the design drawing about a manufacture object on the basis of computer exchange, and concerning said manufacture object, Decomposition condition data required in order to create an exploded view are memorized by the storage means, and let it be a summary to create the exploded view of said design drawing by changing the arrangement location of the components with which an

exploded view creation means is plotted from said configuration data based on said decomposition condition data.

[0013] According to this invention, the configuration data of the components about a manufacture object and decomposition condition data required in order to create an exploded view are memorized by the storage means. And an exploded view is plotted by changing the arrangement location of the components with which an exploded view creation means is plotted from configuration data using these data based on decomposition condition data. Therefore, an exploded view is obtained simply, without creating an exploded view automatically and doing a troublesome plot activity, in case the assembly-operation manual about a manufacture object is offered.

[0014] The configuration data of the components concerning a manufacture object by invention according to claim 5, The step with which incorporate decomposition condition data required in order to create an exploded view, and a computer remembers them to be for a storage means, The step which creates the exploded view of the design drawing about said manufacture object by changing the arrangement location of the components with which an exploded view creation command is answered and said computer is plotted from said configuration data based on said decomposition condition data, Let it be a summary to have recorded the program for making a computer perform the step which said computer makes output said exploded view to an output means.

[0015] According to this invention, the configuration data of the components about a manufacture object and decomposition condition data required in order to create an exploded view are memorized by the storage means. And an exploded view creation command is answered, the exploded view of the design drawing about a manufacture object is created by changing the arrangement location of the components plotted from configuration data based on decomposition condition data, and the exploded view is outputted to an output means. Therefore, an exploded view is obtained simply, without creating an exploded view automatically and doing a troublesome plot activity, in case the assembly-operation manual about a manufacture object is offered.

[0016]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of the exploded view automatic listing device which materialized this invention is explained according to drawing 1 – drawing 10 .

[0017] Drawing 1 is the outline block diagram of an exploded view automatic listing device. The exploded view automatic listing device 1 creates the design drawing of the product used as a design object by CAD. The exploded view automatic listing device 1 is equipped with the control unit 2 as an exploded view creation means, the input unit 3, and the output unit 4 as an output means. A control unit 2 creates the drawing about a product based on the text and the drawing information on a graphic form that it was inputted by the input unit 3, and outputs the drawing to it in the format that an output unit 4 is proper. In addition, a control device 2 consists of CPU, a ROM, RAM, etc., an input device 3 consists of a keyboard, a pointing device, etc., and an output unit 4 consists of a display, a printer, etc.

[0018] The exploded view automatic listing device 1 is equipped with a reader 5, and the program for exploded view automatic creation as a program written in CD-ROM6 as a record medium is read by the reader 5, and it is installed on a hard disk (illustration abbreviation). A control unit 2 creates CAD drawings, such as a group attached chart and an exploded view, as a design drawing of a product based on this program for exploded view automatic creation.

[0019] The exploded view automatic listing device 1 is equipped with the part-shape database 7 and the assembly structure database 8 as a storage means by which the various data inputted using the input device 3 are memorized. The configuration data (three-dimension data) of the components which are the minimum decomposition units of a product are memorized by the part-shape database 7. The various data (assembly structure data, condition data with a group) which decide relating between each part articles to be the assembly structure database 8 are memorized. This assembly structure data sets up whether predetermined components are attached to the components of which point with a group.

[0020] Drawing 2 is the CAD drawing of the product after the completion with a group displayed on a display. The group attached chart 9 of the product M created as a CAD drawing is three-dimensional-CAD data, and is

created based on the configuration data of the components inputted by the user as requirements for a configuration of Product M. That is, the group attached chart 9 of the product M shown in drawing 2 by the configuration data of each part article being attached to predetermined sequence and a predetermined location is done. In addition, the direction of vision (direction to see) can set up the CAD drawing of Product M freely.

[0021] Moreover, Product M consists of a unit 10, a unit 11, and a unit 12 as requirements for a configuration of the maximum upper layer, and elegance is made in part by units 10 and 12 being attached to a unit 11. The unit 10 of these is constituted by components 13-23 (a total of 11 pieces), and elegance is made in part by attaching these components 13-23. In addition, although units 11 and 12 are also constructed with two or more components, the configuration is omitted here.

[0022] Next, a procedure until it creates the group attached chart 9 of the product shown in drawing 2 is explained. First, the configuration data of the components about Product M are created as a drawing for a design, and the assembly structure data about these components are also inputted in parallel to this configuration data origination. By this example, the input screen 24 shown in drawing 3 is displayed on a display, and an assembly structure entry of data is performed by creating the structure data of a tree format. Thereby, Product M consists of three units 10-12 as a ground-floor layer, and it will be set up if the unit 10 of them makes components 13-23 the requirements for a configuration. In addition, configuration data are saved in the part-shape database 7, and assembly structure data are saved in the assembly structure database 8.

[0023] And by clicking each carbon button 25 of components 13-23 on an input screen 24, the input screen 26 shown in drawing 4 is displayed on a display for every each part article, and the condition data with a group between components are inputted. The input column 27 of a location with a group (criteria location) and the input column 28 of a direction with a group (the direction of a three dimension) are formed in this input screen 26. In addition, condition data with a group are equivalent to the decomposition direction condition data.

[0024] Here, a condition entry of data with a group is explained using the example shown in drawing 5 R> 5. In order to specify whether the location of the components (drawing 5 R> 5 components 29) throat used as the candidate for an input is attached to the location of the components (drawing 5 components 30) throat of the point with a group, ****** R of components 29 and ****** S of components 30 are inputted into the input column 27. Here, when components 29 move on the basis of components 30, components 29 and components 30 will be attached.

[0025] Moreover, as the direction with a group of components 30 of components 29 (Ix, Iy, Iz), i.e., a direction with a group, in order to specify the direction with a group over the components 30 of components 29, the include angle to X, Y, and the Z-axis is inputted into the input column 28, respectively. And this condition data with a group is saved in the assembly structure database 8. In addition, the assembly structure data inputted by the input screen 24 and the condition data with a group inputted into these input columns 27 and 28 constitute decomposition condition data.

[0026] If the configuration data of components, assembly structure data, and a condition entry of data with a group are completed with all components and group attached chart creation mode of Product M is performed, a control device 2 will attach components in the procedure with a group decided from assembly structure data and condition data with a group, and will create the group attached chart 9 of the product M shown in drawing 2 . That is, each units 10-12 are separately created by attaching the components 13-23 which are the lowest layers first, respectively, and the group attached chart 9 which attaches these units 10-12 in the next phase, and is shown in drawing 2 is created.

[0027] Next, a procedure until it creates an exploded view from the group attached chart 9 of the product M shown in drawing 2 is explained. First, the direction (include angle) which the CAD drawing which is the group attached chart of Product M looks at is specified. Here, it specifies as a direction which looks at the perspective view 31 made to incline about 30 degrees on the basis of the Z-axis as shown in drawing 6 . In addition, at the time of assignment of this direction to see, the detached building distance between each part articles at the time of decomposition is also specified.

[0028] Processing which specifies the candidate for decomposition is performed after these assignment processings. That is, the "ALL" carbon button 33 and the "UNIT" carbon button 34 are displayed on the

display screen 32 shown in <u>drawing 6</u> at the time of the assignment for decomposition. If the "ALL" carbon button 33 is clicked between two carbon buttons, the whole product will serve as a candidate for decomposition. If the "unit" carbon button 34 is clicked where the unit which wants to create an exploded view is clicked on a display on the other hand, the specified unit will serve as a candidate for decomposition. In this example, as shown in <u>drawing 7</u>, a unit 10 is specified as a candidate for decomposition, and only a unit 10 is taken up and displayed on the display screen 32.

[0029] A carbon button 35 and the "ground-floor layer" carbon button 36 are "altogether" displayed on the display screen 32 shown in <u>drawing 7</u> after this assignment processing. If a carbon button 35 is "altogether" clicked between two carbon buttons, a control unit 2 will create the exploded view which decomposed the candidate for decomposition even into the components unit which is a minimum configuration unit. On the other hand, if the "ground-floor layer" carbon button 36 is clicked, a control unit 2 will create the exploded view disassembled to a ground-floor layer in for [the] decomposition. In addition, in this example, since the lower layer of a unit 10 is the lowest layer, whichever it chooses [of a carbon button 35 and the "ground-floor layer" carbon button 36] "altogether", the same exploded view is created. And decomposition drawing 37 shown in <u>drawing 8</u> as a final exploded view is displayed on the display screen 32.

[0030] That is, a control device 2 creates decomposition drawing 37 by changing the arrangement location of the components displayed on the display based on assembly structure data and condition data with a group. If it explains in full detail, processing which moves the components (<u>drawing 5</u> components 29) used as the candidate for migration in a direction with a group and the contrary direction (the decomposition direction) to the components (<u>drawing 5</u> components 30) used as criteria will be performed for every each part article, and decomposition drawing 37 will be created. Decomposition drawing 37 of this example is created, when components 14-20 move to + Z direction to components 13, components 21 and 22 move to + Z direction to components 20 and components 23 move in the direction of +X to components 13. When a side elevation is incidentally specified as a direction which looks at the CAD drawing of Product M, decomposition drawing 38 as shown in <u>drawing 9</u> is created.

[0031] Next, when creating an exploded view, the procedure which a control unit 2 performs in accordance with the program for exploded view creation is explained according to the flow chart shown in <u>drawing 10</u> R> 0. First, the configuration data of components are incorporated at step (it is only hereafter described as S) 100. That is, the configuration data about the components inputted by the user are incorporated from the part-shape database 7.

[0032] Assembly structure data are incorporated in S110. That is, the assembly structure data in which the relation between each part articles specified by the user is shown are incorporated from the assembly structure database 8.

[0033] Conditions with a group are incorporated in S120. That is, the condition data with a group in which relating between the components and components which were specified by the user is shown are incorporated from the assembly structure database 8.

[0034] An exploded view creation command is inputted in S130. That is, drawing creation mode is set as exploded view creation mode. The direction which an exploded view looks at is specified in S140. That is, it is set up by making a user specify the direction which the group attached chart on a display looks at at which include angle the exploded view finally done is obtained.

[0035] The candidate for decomposition is specified in S150. That is, when the "ALL" carbon button 33 displayed on a display is chosen and the "UNIT" carbon button 34 is chosen for the whole product, a unit is specified as a candidate for decomposition. When a carbon button 35 is chosen "altogether" and the "ground-floor layer" carbon button 36 is chosen [which was displayed on the display] for all the candidates for decomposition in the next phase, even eye a ground-floor layer for selection is specified as a candidate for decomposition.

[0036] Exploded view creation processing is performed in S160. That is, decomposition drawing 37 is created by moving each part article to the arrangement location decided from the condition data with a group based on assembly structure data and condition data with a group.

[0037] In S170, display processing to an output unit 4 is performed. That is, decomposition drawing 37 is

displayed on a display, or a printout is carried out from a printer. And a user operates an input unit 3 if needed, and an arrangement change of the components is made to a desired location, or he describes the explanatory note about components.

[0038] By the way, the manual for the assembly operation may be needed about the assembly operation of Product M. In this example, when the control device 2 assembles the components plotted from the basis of the physical relationship of assembly structure data, and configuration data along with condition data with a group, creation of the manual for assembly operation using CAD data is attained. Thereby, the procedure with a group about Product M can be offered as a manual for assembly operation to the operator who manufactures Product M in sites, such as works. Furthermore, the design check of whether the design drawing of Product M was created correctly can also be performed.

[0039] Moreover, in a manufacture site, in order to exchange the broken components about maintenance of Product M, an exploded view may be needed. In this example, decomposition drawing 37 is created by moving components in the decomposition direction in which a control device 2 is decided from condition data with a group based on assembly structure data and condition data with a group, and changing the arrangement location of components, and an operator is provided with it as a manual for assembly operation. Therefore, decomposition drawing 37 about the design drawing of Product M will be created automatically, and, as for a user, decomposition drawing 37 will be simply obtained at the time of a parts replacement.

[0040] Therefore, the following effectiveness can be acquired with this operation gestalt.

(1) Decomposition drawing 37 is created by moving the arrangement location of the components with which a control device 2 is plotted from configuration data based on assembly structure data and condition data with a group in the predetermined decomposition direction as a manual for the assembly operation of Product M. therefore, an operator (user) -- the basis of computer exchange -- decomposition drawing 37 can be created automatically, and when performing exchange of components etc. about maintenance of Product M, decomposition drawing 37 can be obtained easily.

[0041] (2) A control device 2 creates assembly drawing 9 by assembling the components plotted from the basis of the physical relationship of assembly structure data, and configuration data along with condition data with a group. Therefore, the procedure with a group of Product M can be offered also as that of computer exchange to the operator who manufactures Product M. In addition, an operator can also do the activity of a design check of Product M by offering the manual for assembly operation.

[0042] (3) The condition data with a group used as data required in order to create decomposition drawing 37 in case Product M is plotted are used. Therefore, when creating decomposition drawing 37, data new for the exploded view creation are not needed. Moreover, since the direction of a three dimension is inputted into condition data with a group as a direction with a group, it is the thing of three-dimension correspondence and decomposition drawing 37 can be plotted.

[0043] (4) Since it has composition which chooses the whole product M and each units 10-12 as a candidate for decomposition, the candidate for decomposition can be freely set up between the whole product M or each units 10-12, and the exploded view according to a specification can be created.

[0044] In addition, an operation gestalt is not limited above, for example, may be changed into the following mode.

- It is not limited to decomposition condition data consisting of assembly structure data and condition data with a group, and if it is data required in order to create the exploded view to a design drawing, especially the contents will not be asked. For example, although the direction with a group of a three dimension was inputted as a decomposition direction, you may be two-dimensional or one dimension if needed.

[0045] - The decomposition direction condition data are not restricted to condition data with a group. For example, it is good also considering the data which newly inputted data in order to create decomposition drawing 37 of Product M, and were inputted at this time as decomposition direction condition data.

[0046] - If the condition data with a group specified as conditions with a group are required in order not to be limited to the data inputted into the input screen 26 shown in drawing 4 but to create decomposition drawing 37, the contents of data will not be asked.

[0047] - Neither assembly structure data nor the condition entry-of-data format with a group is limited to the

gestalt of this example. Among these, it may be made to perform a data input by adding assembly structure data to the configuration data in parallel to the configuration entry of data of components rather than inputting [for example,] assembly structure data in a tree format. Moreover, not the gestalt that opens an input screen 26 but the thing similarly performed in parallel to a configuration entry of data is sufficient also as condition data with a group.

[0048] – It is not limited to the candidate for decomposition being the whole product M or a unit simple substance. For example, a control unit 2 makes components to make it disassemble to a user specify, and you may make it create the exploded view where only the specified component was disassembled by taking up.

[0049] – As long as a drawing design can do the system which plots a design drawing not only as a CAD system but as that of computer exchange, a system format may be chosen freely.

[0050] – A record medium is not limited to CD-ROM6, for example, may use other media, such as a floppy (trademark) disk and a memory card.

– The object of a design drawing can use the exploded view automatic listing device 1 of this example, when it is not limited to a product M like this example but the design drawing of a variety of products, such as autoparts, an electric product, a machine tool, and a toy, is created.

[0051] The technical thought which can be grasped from said operation gestalt and example of another is indicated with the effectiveness below.

(1) Said decomposition condition data have the location conditions which specified the installation location between each part articles, and the decomposition direction conditions specified the direction of a three dimension as a decomposition direction, and it is moving said component based on these conditions in the direction of a three dimension decided from the decomposition direction conditions, and said exploded view creation means changes the arrangement location of these components, and creates said exploded view in claims 1–3. In this case, the exploded view corresponding to a three dimension can be created.

[0052] (2) In claims 1–3 and said technical thought (1), said exploded view creation means creates said exploded view per each [of the unit of said whole manufacture object or this manufacture object] according to assignment for decomposition. In this case, the exploded view of the whole manufacture object and the exploded view of a unit can be created if needed, and the exploded view according to a specification can be created.

[0053] (3) Said decomposition condition data consist of assembly structure data in which the relation between each part articles is shown, and decomposition direction condition data in which the migration direction of the components at the time of decomposition is shown, and said exploded view is created in claim 4 by changing the arrangement location of said component in the decomposition direction decided from these decomposition direction condition data based on said assembly structure data and the decomposition direction condition data. In this case, the same effectiveness as claim 2 is acquired.

[0054] (4) In claim 4, said decomposition direction condition data are condition data with a group inputted as conditions with a group for attaching components, when creating the group attached chart of said design drawing, and said exploded view is created by changing the arrangement location of said component based on said condition data with a group. In this case, the same effectiveness as claim 3 is acquired.

[0055] (5) Said decomposition condition data consist of assembly structure data in which the relation between each part articles is shown, and decomposition direction condition data in which the migration direction of the components at the time of decomposition is shown, and said exploded view is created in claim 5 at said step which creates an exploded view by changing the arrangement location of said component based on assembly structure data and decomposition direction condition data in the decomposition direction decided from these decomposition direction condition data. In this case, the same effectiveness as claim 2 is acquired.

[0056] (6) In claim 5, said decomposition direction condition data are condition data with a group inputted as conditions with a group for attaching components, when creating the group attached chart of said design drawing, and at said step which creates an exploded view, said exploded view is created by changing the arrangement location of said component based on said condition data with a group. In this case, the same effectiveness as claim 3 is acquired.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The outline block diagram of the exploded view automatic listing device in 1 operation gestalt.
[Drawing 2] The CAD drawing of the product after the completion with a group displayed on a display.
[Drawing 3] Assembly structure entry-of-data screen Fig.
[Drawing 4] A condition entry-of-data screen Fig. with a group.
[Drawing 5] The explanatory view about condition data with a group.
[Drawing 6] The screen Fig. where the group attached chart of a product was displayed.
[Drawing 7] The screen Fig. where an assignment indication of the one unit was given.
[Drawing 8] The screen Fig. where the exploded view of a unit was displayed.
[Drawing 9] Other screen Figs. where the exploded view of a unit was displayed.
[Drawing 10] The flow chart performed by exploded view creation time.
[Description of Notations]
1 [-- CD-ROM as a record medium, 7 / -- The part-shape database as a storage means 8 / -- The
assembly structure database as a storage means 9 / -- A group attached chart, 13-21 / -- 37 Components,
38 / -- An exploded view, M / -- Product as a manufacture object.] -- An exploded view automatic listing
device, 2 -- The control unit as an exploded view creation means, 4 -- The output unit as an output means, 6
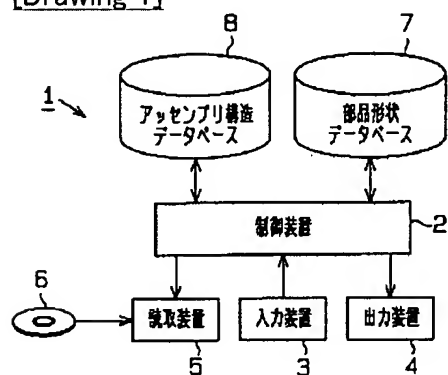

[Translation done.]

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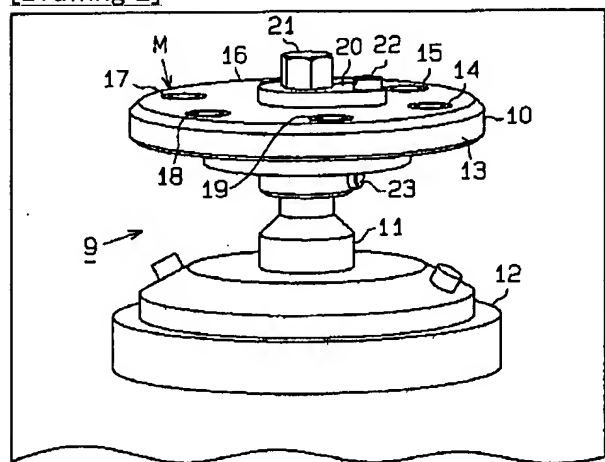damages caused by the use of this translation.

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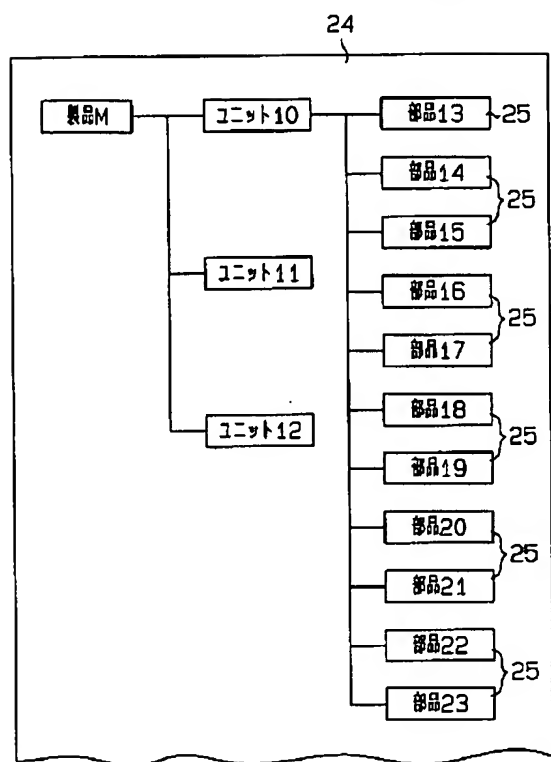3.In the drawings, any words are not translated.
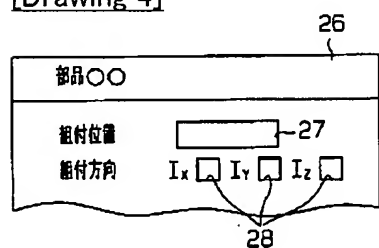
DRAWINGS
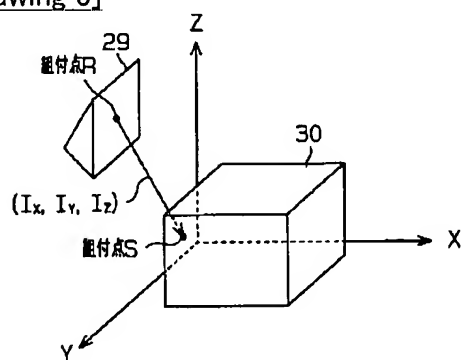
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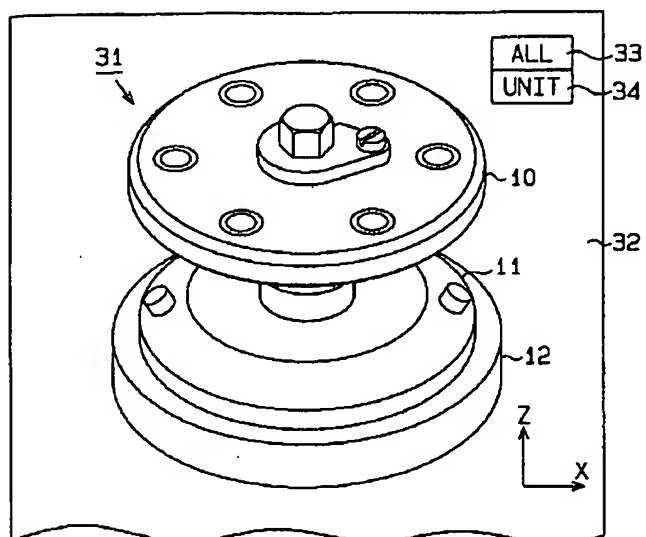

[Drawing 2]

[Drawing 3]

24

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製品M ── ユニット10 ── 部品13 ─25
                        部品14 ┐
                              ├25
                        部品15 ┘
           ユニット11 ── 部品16 ┐
                              ├25
                        部品17 ┘
           ユニット12 ── 部品18 ┐
                              ├25
                        部品19 ┘
                        部品20 ┐
                              ├25
                        部品21 ┘
                        部品22 ┐
                              ├25
                        部品23 ┘
```

[Drawing 4]

26

部品○○		
組付位置	☐──27	
組付方向	I_x ☐ I_Y ☐ I_z ☐	

28

[Drawing 5]

Z

29

組付点R

(I_x, I_Y, I_z)

30

組付点S

X

Y

[Drawing 6]

[Drawing 7]

[Drawing 8]

[Drawing 9]

38

21

22

32

17 18 16 14

20

10

13

Z

X

23

[Drawing 10]

スタート

部品の形状データの取り込み ～S100

アッセンブリ構造データの取り込み ～S110

組付条件の取り込み ～S120

分解図作成指令の入力 ～S130

見る方向の指定 ～S140

分解対象の指定 ～S150

分解図作成処理 ～S160

出力装置への表示処理 ～S170

エンド

[Translation done.]